Hardrock Mining: Risks to Community Health

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Overview

Overview

Hardrock mining – the extraction of minerals such as gold, silver, lead, copper and uranium from the earth is practiced in a manner inherently threatening to human health. Several studies have addressed work-related illnesses suffered by hardrock miners. Yet relatively few studies have looked at hardrock mining's greater ecological effects and its effects on people living near, downstream or downwind from mines.

The goal of this report is to begin to address the gap in scientific study and public information regarding risks for people living near modern mines. In doing so, it seeks to raise awareness of the importance and urgency of the issue and to catalyze further investigation.

An Archaic Law at the Heart of the Problem

The General Mining Act of 1872, still the primary legislation governing mining in the United States, allows speculators to stake and develop hardrock mining claims on public lands with relatively little regulatory oversight and requires no royalty payment to the government on minerals extracted. When the law was developed, our young country's political leaders wanted to encourage unbridled exploration for both precious (i.e., gold and silver) and industrial (i.e., copper and lead) metals.

Yet, the authors of The General Mining Act of 1872 and the miners of the time, equipped with pick, shovel and pan, could not have pictured what hardrock mining would become in the future.

Impact

The Massive Impact of Hardrock Mining Today

Commercial mining today is industrial in scale, usually involving the blasting, crushing and dumping of thousands of acres of land for one mine. Hardrock mining is a chemical-intensive operation – cyanide, sulfuric acid and explosives are among the toxic substances routinely used to extract minerals. It is not uncommon for a modern gold mine to extract 60 tons of rock to yield just one ounce of gold. The possible adverse effects to the environment and human health of such an operation are enormous and myriad.

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These dramatic impacts of today's industrial mining operations stem from:

- **Modern mining technology and techniques**, including blasting enormous open pits in the ground; applying massive quantities of toxic chemicals, such as cyanide and sulfuric acid; and heating metals to extremely high temperatures, which can release harmful air pollution.
- **Dangers inherent in the metals themselves**, such as uranium and lead, which are widely known to threaten human health. The massive earthmoving involved in most modern mines can also release harmful constituents in addition to the desired mineral, such as asbestos, radioactive gases, arsenic, mercury and others.
- **Human error**, such as truck accidents, train derailments, ruptured containment liners and poorly engineered mountains of waste, which have all resulted in environmental damage or threats to human health.

- **Air and water transport of pollution**, which can carry pollution far from its original source. Mercury emitted as air pollution can travel hundreds, even thousands, of miles from its source.
- **Commercial transport of pollution**, for example on transportation corridors between uranium mines and mills there are frequently high levels of health-threatening contamination.

Effects

> **The United States Environmental Protection Agency estimates that the headwaters of 40% of the watersheds in the western U.S. are contaminated by pollution from hardrock mining.**

The Adverse Effects of Industrial Mineral Extraction

Pollution of air, drinking water, rivers and soils and loss of vegetation are common ecological impacts of modern mines. The United States Environmental Protection Agency estimates that the headwaters of 40% of the watersheds in the western U.S. are contaminated by pollution from hardrock mining.

Adverse health effects to those living near, downstream or downwind from mines can be substantial. While each scenario is unique, the three case studies below suggest the extent and nature of problems associated with hardrock mining:

- **Lead Poisoning.** Herculaneum, Missouri is home to the largest lead smelter in the United States. Significantly high levels of lead have been detected in soil, dust and air samples in the residential community surrounding the smelter. Up to 28% of children in Herculaneum have blood-lead levels higher than the federally mandated "level of concern". The national average is 2.2%. Women aged 15-44 also have elevated blood-lead levels that are nearly twice the national average.

- **Respiratory Disease.** Libby, Montana, where miners and the general population were exposed to tremolite asbestos, a byproduct of mining for vermiculite, for many years. One study found that between 1979 and 1998, death rates from respiratory diseases in Libby were 40% higher than national averages. The same study found the death rate from asbestiosis in Libby to be 63 times higher than expected.

- **Mercury Pollution.** British Columbia's Pinchi Lake became a waste bin for mining giant Teck Cominco's mercury mine and processing plant. One study found mercury concentrations in muscle tissue of Pinchi Lake fish, the primary food source of the resident Tl'azt'en First Nation communities, as high as 10.5 parts per million. The Canadian Food and Drug Administration's maximum acceptable level is 0.5 parts per million.

Photo: Missouri Department of Natural Resources

In addition to the cases outlined above, this report explores a set of threats in other specific places where scientific studies have shown substantial impacts to human health, including:

- **Uranium Mining in Indian Country** – Between the 1940's and 1960's there were 2,500 uranium mines and four uranium mills operating in Grants Mineral Belt in the Four Corners region. Native American mine workers were disproportionately exposed to the risks associated with uranium mining, and they suffered disproportionately from lung cancers and other respiratory diseases.

- **Lead Mining in the Northern Rockies, Alaska and the Midwest** – This report reviews extensive health studies evaluating threats associated with lead contamination from mining in Alaska, Missouri, Montana and Idaho.

- **Mercury Pollution from Mining** – Nationwide, mining contributes 9% of all mercury air pollution, which causes brain and kidney damage, behavioral disorders and other health problems. 92% of these emissions are released from four major mining operations in the state of Nevada, making it the state with the second highest emissions of airborne mercury nationwide.

The case studies in this report also look at several primary environmental pollution pathways with substantial potential to harm human health, but where insufficient research has been conducted to determine the actual threat.

- **Acid Mine Drainage** – One common environmental problem is acid mine drainage, which occurs when sulfite-containing mining waste or rock is exposed to water and oxygen, forming sulfuric acid. While human health impacts of acid mine drainage have not been extensively studied, it has been determined that the high levels of exposure to arsenic, manganese and thallium – potential byproducts of acid mine drainage – can increase the risk of cancer and other illnesses in humans.

- **Cyanide in Gold and Silver Mines** – Cyanide presents a serious health threat in modern mines, as it is extremely lethal in very small doses. While it breaks down quickly, there are risks associated with the resulting compounds, which can persist in the environment and bio-accumulate in the food chain.

- **Threats to Drinking Water** – At operating mines, the risk of an accidental release of waste into drinking water sources is ever-present. A report by the EPA listed 95 major incidents in eight states between 1990 and 1997.

- **Transboundary Issues** – Mining at or near the U.S. border creates contamination and public health problems that must be managed by more than one country, causing complex enforcement and reclamation.

- **Social and Emotional Health Impacts** – Mining may also have negative effects on the quality of life and lifestyle choices in surrounding communities. These impacts can manifest themselves in physical or emotional illness among individuals and also in substantial changes in the behavior of an entire community.

Challenges

Why Haven't I Heard About This Before?

The mining industry operates out of sight and out of mind of most citizens and the media.

The mining industry operates out of sight and out of mind of most citizens and the media. Given the remote locations of the vast majority of hardrock mines, most Americans have never seen first-hand the scale of environmental damage caused by mining.

This lack of public awareness is exacerbated by documented threats being downplayed by pro-industry western politicians. The combination of limited public awareness and a bureaucratic "blind eye" has allowed the mining industry to operate with little substantive regulation of its impacts and few requirements for restoration of the land after mining has ceased.

The Challenges of Cleanup

One of the greatest challenges in addressing health impacts in mining communities is that no one knows how to fix the problem. Many millions of dollars have been invested into the science of how to extract ever-smaller concentrations of gold from rock, yet very little investment has gone into determining how to put the earth back together once it has been blasted, crushed and saturated with chemicals.

Taxpayers are often stuck with the cost of reclaiming damaged mining sites and reducing sources of harm to environmental and human health. In one example of reclamation's staggering costs, state agency representatives in New Mexico recently estimated cleanup for two large open pit copper mines at more than $800 million. The limits of current engineering capable of returning land to its pre-mining condition and the enormous financial costs of attempting to do so offer strong testimony as to why these problems should be prevented rather than addressed after the fact.

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Opportunities

What Can be Done?

The risks posed to human health by both historic and modern mining are real. In specific locations, such as Libby, Montana, or Laguna Pueblo, New Mexico, mining has devastated the health of individuals, whole families, neighborhoods and entire communities.

A relatively small amount of new money to support mining health advocacy efforts can make a big difference. Investment in improving the health of communities impacted by mining will serve not only to reduce the current risk but also to illustrate the need for broader changes in the policies that allowed the contamination to occur. Providing financial resources to expose mining's impacts on human health will also raise important issues associated with fundamental environmental laws the mining industry has treated as mere suggestions.

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New efforts to reform modern mining and adequately provide for the cleanup of abandoned mines provide a timely opportunity. It is essential that we:

- **Require regulatory agencies to fully establish the risks** associated with proposed new mines.
- **Require regulatory agencies to monitor pollutants** that threaten health, from historic, current and proposed mines.
- **Provide information on the health risks** of mining in a form easily accessible and comprehensible to the general public.
- **Engage local communities** in the permitting and oversight of the industries directly impacting their communities.
- **Mandate regulatory agencies to secure reclamation bonds** sufficient to cover the comprehensive costs of protecting human health many decades after the mine has closed.

These provisions, based on an accounting of the true costs of mining, will better protect the health of people working in, living near and those otherwise impacted by hardrock mining.

Section II
Introduction to Health and Mining Issues

For many Americans, mining in the western states brings to mind the image of a rugged pioneer wielding a gold pan or pick and shovel. Commercial mining today, however, is done on an industrial level that is unprecedented in scale and impact. The primary law governing mining, passed in 1872, could not have anticipated the scale of current mining operations and is inadequate for their regulation. These operations present real threats to the health of people and ecosystems in the vicinity of mines and often for hundreds of miles downstream. This report outlines some of modern mining's impacts to the health of human communities.

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The term "mining" refers to a wide range of practices related to extracting minerals from the earth. Strip mining for coal, excavating for sand and gravel and blasting for gold and other minerals all constitute different types of mining. This paper focuses on the health impacts of mining what are known as hardrock minerals – including gold, silver, copper, uranium, lead and molybdenum.

Hardrock minerals are the most loosely regulated natural resources in U.S. mining. This may be because some of the metals on the list, such as gold, are valued for beauty rather than utility. Also, metals such as copper and uranium have had a strategic use, so our government has encouraged their development in the name of national security. Finally, because hardrock mining largely has been concentrated in sparsely populated western states, where the impacts were less visible to the majority of the population, most Americans are unaware of its adverse effects. As a consequence, loose regulation has gone unnoticed outside impacted areas.

Regardless of the reasons, hardrock mining has been allowed to develop under different standards than those regulating other industries. There are three special conditions concerning companies developing these minerals that are true for no other type of mining:

- **The right to mine.** Federal land managers interpret the 1872 Mining Law as forbidding them from denying any corporation the right to mine hardrock minerals on America's public lands. While land managers can impose restrictions on aspects of the mining operation, they believe that the law states that mineral extraction is the preeminent use of national public lands. They therefore cannot choose to deny a mine proposal, even after a balanced consideration of risks to public health, water, air, wildlife or soils.

- **No national standards for reclamation.** Because the mining law for hardrock minerals was established in the 19th century, there are no uniform standards for cleaning up and "reclaiming" the land at a mine site. These regulations were left for each state to define. In practical terms, this has meant that in pro-industry mining states such as Nevada, Arizona, Montana, Colorado and New Mexico, toxic contamination has been allowed to persist. As a result, health threats are beginning to emerge.

- **No royalties are paid for taking public minerals.** While the lack of royalties paid for hardrock minerals does not have a direct impact on public health, it allows development of projects with only marginal economic potential. Health and environmental costs are then externalized for the public to bear. If a company wanted to drill for oil and gas on federal public lands, it would pay a 12% royalty for profiting from minerals that belong to all Americans. If the same company wanted to mine for coal on that same piece of land, it would pay an 8% royalty for the same privilege. However, if that company seeks hardrock minerals, it can take these resources with no fee paid to the American taxpayer. This also results in fewer resources for government agencies to adequately monitor and regulate these mine sites.

A Picture of the Modern Mine

Photo: Montana Environmental Information Center

Hardrock mining (hereafter referred to in this paper simply as "mining") threatens human and environmental health because it is inherently toxic and destructive. Commercial mining in America is no longer done with a pick and shovel. The giant nuggets and rich veins of gold largely have been extracted. Left behind are tiny flakes of gold encased in tons of rock. This scenario is generally true with many other minerals, and as minerals become scarce, methods for their extraction become more destructive.

Today's typical gold mine involves massive blasting, resulting in massive craters scarring the earth. In some cases, whole mountains are dynamited to rubble, and then dug still deeper. It is common today to extract as many as 60 tons of ore to produce one ounce of gold.

The remaining open pits can be up to one thousand feet deep and many thousands of feet across. The pits are often dug deeper than the water table, and unless there is active pumping they fill with water and can become artificial lakes. These lakes may quickly become toxic, contaminated by the high mineral concentration from the raw walls and rubble along the edges of the giant hole. The pit lakes sit as a toxic attraction to wildlife and migratory birds looking for a resting spot. As the poison leaches into water supplies below, it threatens the integrity of groundwater.

The rock extracted from the open pit is blasted into smaller rocks and stones. The part that does not contain the desired minerals is known as "waste rock" and is piled in massive hills, some reaching hundreds of feet high. This rock, now dug up, crushed and exposed to air and water, releases minerals that were previously locked safely in the ground. Naturally occurring sulfur

mixes with air and water to become sulfuric acid, or what is now called “acid mine drainage.” This acid runoff can flow to nearby streams, rivers and lakes and also facilitates the leaching of heavy metals, including selenium, iron and others toxic to humans.
The crushed rock containing the desired mineral is processed to further extract that mineral. Several methods can be used, but smelting and leaching are two of the most common. In smelting, the rock is heated to extremely high temperatures and can release tremendous amounts of toxic gases into the air. In leaching, rock is usually spread in a great heap, hundreds of acres in size, and drenched with a solution (cyanide solution is used most commonly for gold and silver) that will bind with the mineral and carry it to drain pipes at the bottom of the enormous pile. Leaks of toxic solutions are common in this practice and can contaminate ground or surface water.

Mine sites often look like moonscapes. They are devoid of vegetation and filled with broken rock and dirt. The continuous traffic of heavy equipment, kicks up great clouds of dust, compromising air quality in the surrounding area.

Human Health Impacts

Modern mining’s legacy is more than 10,000 miles of polluted streams, hundreds of contaminated lakes, mountains reduced to craters and landscapes devoid of life where thriving forests and fragile deserts once existed. The effects of mining’s impact on the earth are magnified in their effects on human health. Most of the people living in impacted communities don’t know their health is at risk until their families, relatives or neighbors begin showing signs of illness. Dozens of communities across the western U.S. have been affected, but few people outside these areas understand the extent of the damage.

In 2002, the London School of Hygiene completed a study of mining’s impacts on human health for an industry association known as Mining, Minerals and Sustainable Development. The study found that of the 996 health studies reviewed, all but 80 of them examined health effects on mine workers, as opposed to impacts on people living in the communities near mines (Stephens, 2002).

This report seeks to address this gap by summarizing some recent scientific studies documenting the health impacts faced by the communities near modern hardrock mines. It is not intended to be comprehensive, and as such it does not list all communities where mining has caused harm to human health. Rather it uses a handful of examples to illustrate the types of illnesses that may be related to modern mining and the many reasons for concern.

Americans are familiar with the pioneering image of the coal miner, his face blackened by long hours in a difficult and dangerous work environment. The high incidence of Black Lung, however, provided a harsh reality check on the costs of our industrial dependence on coal. Similarly, the human faces representing the true costs of hardrock mining must now be exposed.

Proposals for new mines, toxic pollution left behind with no corporate responsibility for cleanup, and dwindling resources for government-led cleanups all bring urgency to this issue. Even more compelling are the individuals and communities that continue to be exposed to pollution that sickens them.

Section III

The Risks to Health: Case Studies in the United States

Health impacts from mining are diverse and complex. They depend considerably on the metal being mined, the method used to extract the metals from the surrounding rock, the location, other minerals in the rock and the waste materials. Specific metals are inherently risky to extract – uranium and lead are notable in this regard. In addition, variables exist due to how the minerals are processed. Particular aspects of processing that might cause unique health threats include:

- **Smelting**, where the ore is processed at high temperatures. Toxic gases can be released through air emissions and heavy metals discharged into ground and surface waters.
- **"In situ leach" mining**, where the ore is processed in place in the ground. Hazardous pollutants can be released into streams, lakes or drinking water wells.
- **Heap leaching**, and other leach methods, where chemicals such as cyanide or sulfuric acid are employed. Leaks of toxic solutions are common and can contaminate ground or surface water.

In examining individual mining sites, one must consider also the broader geographical possibilities for contamination. Mining pollution often is distributed far from the actual mine site and can create public health impacts along the route. Smelters, for example, emit huge amounts of pollutants, such as lead and mercury, which can be carried hundreds of miles by wind and water.

The vast majority of scientific literature related to health impacts of mining have focused only on risks to mine workers. Very little research has been conducted on the exposure and relative risk for residents living in the area of a mine, or along a corridor of transported pollution.

Pollution from the ASARCO smelter in East Helena, Montana is known to contaminate a 100-square-mile area around the site (U.S. EPA, 1995). Serious health risks to children have been identified, to the point where lawns and yards have been dug up and removed due to the danger of lead exposure (U.S. EPA, 2003c). Water-borne pollutants (e.g., heavy metals) resulting from acid mine drainage can pollute communities well downstream of the mine.

In western Montana, mining waste and tailings from historic copper mining in Butte have systematically polluted a 120-mile stretch of the Clark Fork River (Clark Fork, 2003). Dust and other waste stemming from transportation of mined ore and concentrate can also create contaminated corridors; in the Southwest, mined uranium transported by train has left high levels of radioactivity detectable along the tracks (Stephens, 2002).

In all cases, the potential dangers of chemicals used in mining and the associated impacts are intensified when one accounts for accidents or human error-caused catastrophes. The transportation corridor between the Midnite uranium mine in eastern Washington and the associated Dawn mill site contains high levels of radioactivity all along the roadway (SEPAL, 2003d). Accidents and spills from trains, trucks or leaking plastic liners beneath leach pads, and the occasional massive failure of a retention dam or tailings pile have left toxic wastelands that extend far beyond mines themselves.

The vast majority of scientific literature related to health impacts of mining have focused only on risks to mine workers. Very little research has been conducted on the exposure and relative risk for residents living in the area of a mine, or along a corridor of transported pollution. The following section highlights several examples of mines where both miners and people in surrounding communities have suffered adverse health effects.

Uranium Mining in Indian Country

Uranium mining began in the early 20th century in the southwestern region of the United States. Advances in both technology and the understanding of potential uses for uranium triggered a "uranium rush" in the 1950s. Major uranium operations were established on the Colorado Plateau in Arizona, Utah, Colorado and New Mexico, predominately on Native American reservation lands. A smaller rush occurred around the Black Hills of South Dakota and in eastern Washington, in both cases on Indian lands.

One of the largest uranium belts in the world, the Grants Mineral Belt, is located in the Four Corners region on and near the Navajo Nation and Laguna and Acoma Pueblo lands. Between the 1940s and 1960s there were 2,500 uranium mines and four uranium mills operating in this area (Mulloy, 2001). Mine and mill workers have suffered significant health effects from toxic occupational exposures in the uranium mines (Roscoe, 1995, Gilliland, 2000).

The primary health impact to uranium miners is the risk of lung cancer from exposure to radon in the mines. Extensive cohort studies of uranium miners in Arizona and New Mexico found significantly higher rates of lung cancer in uranium miners than in the general population (Roscoe, 1995). Uranium miners were also exposed to high concentrations of dust, leading to non-malignant respiratory diseases, as well as significantly elevated risk of pneumoconiosis, tuberculosis, silicosis and emphysema (Roscoe, 1995). It is estimated that up to 3,000 Navajo workers labored in the uranium mines and mills in the area; accordingly Navajo miners were disproportionately impacted by their exposure. Studies of Navajo miners specifically show rates of lung cancer, pneumoconiosis and tuberculosis significantly higher for Navajo miners than for Caucasian uranium miners. The risk of disease in Navajo uranium miners was shown to increase when correlated with the length of time spent working in the mine (Roscoe, 1995, Gilliland, 2000).

Uranium mines pose risks to community members even when they don't work in the mines. One study showed that Navajo women living near tailings or mine dumps were significantly more likely to have miscarriages (Shields, 1992). Studies of community members near uranium mines in Texas revealed subtle changes in their DNA. Higher rates of chromosomal aberrations and abnormal DNA repair mechanisms were seen in residents living near the mines, when compared to residents in non-mining communities (Au, 1995). While chromosomal damage does not cause illness directly, aberrations pave the way for genetic mutations, potentially giving rise to cancers, birth defects and other conditions.

Uranium mining in the Southwest virtually came to an end in the 1980s when international sources of uranium became more competitive. In 1983, the Navajo Nation, under President Peterson Zah, declared a moratorium on all new uranium mines on the reservation. Recently, however, a proposal to create an in-situ leach uranium mine at Crownpoint, New Mexico has been forwarded. While in-situ leach mining involves a different process with less exposure for mine workers, the process poses a substantial risk of contamination of groundwater (Mudd, 2001).

In in-situ leach mining, sodium bicarbonate is injected into the ground in the aquifer where the uranium occurs. This solution mobilizes the uranium out of rock and into groundwater. Pumping wells (placed in a spoke pattern around the injection wells) extract the uranium-loaded solution and bring it to the surface. Many residents of Crownpoint fear that the town well, which provides a rare source of high-quality drinking water for many tribal members across the southeastern region of the reservation, will be contaminated. (The well lies only a half-mile down-gradient from the proposed mine site.) Additionally, proposed processing facilities lie just upwind of homes, churches and schools, and people fear that airborne radionuclides will once again be released into their communities. The Crownpoint-based Eastern Navajo Dine Against Uranium Mining (INDIUM) has led the fight against authorization of this mine.

Navajo tribal members are justifiably concerned not only about a new uranium mine but also about a new processing facility. Uranium mills, where uranium is processed, may pose health risks to their surrounding communities through the use and storage of large quantities of radioactive wastes. The largest U.S. release of radioactive waste occurred at the Church Rock mill in Church Rock, New Mexico in 1979. Eleven hundred tons of radioactive mill waste and 93 million gallons of contaminated liquids from the tailings pond were released into the Rio Puerco River when the pond's dam failed. This accident caused extensive contamination all along the Rio Puerco basin. The Church Rock mill closed in 1982, and the site was placed on the National Priority List for Superfund cleanup in 1983 (U.S. EPA 2002b). This disaster caused concern about the vulnerabilities of other uranium mill sites, including the Atlas Mill near Moab, Utah. That 400-acre mill site includes a 130-acre tailings pile containing 11.9 million tons of uranium tailings. The site is located on the Colorado River upstream from Lake Mead, a major drinking water source for Las Vegas and other communities. The Atlas mill site cleanup process is still in its beginning stages (U.S. DOE, 2003).

Lead Mining: Case Studies from the Northern Rockies, Alaska and the Midwest

Silver Valley/Bunker Hill Superfund Site
Silver, lead and zinc mining began in the Silver Valley area in northern Idaho in the late 1800s. In 1917, a large smelter was added to the site. Today, the Silver Valley/Bunker Hill site is one of the largest Superfund sites in the country, with an active cleanup area of 21 square miles. Contamination from the site goes well beyond the 21-square-mile "box;" heavy metals from the mines have been found throughout the Coeur D'Alene basin and as far west as the Spokane River in Washington (U.S. EPA, 2003e).

Health impacts from the mining at this site are predominately related to the extensive lead contamination of the area. Household dust and backyard soil are two primary pathways for lead exposure; high levels of lead were discovered in both in Silver Valley. In addition to increased blood pressure and damage to organs such as the kidney and liver, the developing brains of children are very sensitive to leadwith effects occurring at very low levels of exposure. Impacts include behavioral disorders, learning deficits and lowered IQ (U.S. EPA, 2003a). Behavioral disorders include aggression and impulsiveness. Children with low-level lead exposures are also less likely to finish school and more likely to have trouble with the law (Needleman, 1996).

Measurements of blood lead levels in children of the Silver Valley area began in the early 1970s, when damage from a fire in the baghouse of the smelter led to exceedingly high emissions of lead in the area. Twenty-two percent of the children tested in 1974 had blood-lead levels higher than 80 micrograms per deciliter (ug/dl) (Rosen, 2003). By comparison, the "level of concern" set by the Centers for Disease Control (CDC) is 10ug/dl. While cleanup activities and educational efforts have served to lower lead exposure in Silver Valley children, blood-lead levels are still elevated compared to the rest of the country. Up to 29% of Silver Valley children still have blood-lead levels greater than the level of concern (10 ug/dl) whereas the national average is about 2.2% (Rosen, 2003, CDC, 2003). This is one of the highest blood-lead levels in children in the United States.

Exacerbating concern about the risks to children in the Silver Valley are recent medical studies showing that CDC's level of concern for lead poisoning may still be too high. Detrimental neurological effects to children have been shown at levels much lower than 10ug/dl (Brody, 2003).

ASARCO East Helena Lead Smelter
The lead and zinc smelter in East Helena, Montana was installed in 1888 and operated until 2001. Data from 2000 (the last full year of operation) reported to the Toxic Release Inventory indicates that the ASARCO smelter was responsible for over 16,000 pounds of airborne lead emissions that year alone (TRI, 2000). Pollution from the smelter is estimated to have contaminated a 100-square-mile area (U.S. EPA, 1995). An 8.4-square-mile area immediately surrounding the smelter became a Superfund site in 1983. As in Silver Valley, the greatest health concerns regard lead exposure to children. In 1975, the average blood-lead level in East Helena children was measured at 28 ug/dl. Residential soil removal efforts and educational programs sharply decreased the average blood lead level in children to 2.8 ug/dl by 2001 (Lewis & Clark, 2003).

Arsenic contamination is also closely associated with lead smelting. In East Helena, numerous violations of arsenic water quality standards have been reported in Prickly Pear Creek, which received discharges from the ASARCO smelter (U.S. EPA, 1995). A groundwater arsenic plume with concentrations up to 4900 parts per billion (ppb) was also discovered to have migrated off-site toward a residential area. For the sake of comparison, the average U.S. concentration of arsenic in groundwater is approximately 1 ppb (ATSDR, 2000). In Montana, the average concentration of arsenic in groundwater is about 3 ppb (NRDC, 2000). In 2002, the Agency for Toxic Substances and Disease Registry (ATSDR) concluded that ingestion of the groundwater constituted a public health hazard for residents living above the plume. The ATSDR recommended that homeowners above the plume cease use of their residential wells and switch to using the municipal water system for household water needs (ATSDR, 2002). Acute exposure to arsenic is known to have gastrointestinal, neurological and cardiovascular effects. Arsenic is also a known human carcinogen (ATSDR, 2000).

Oronogo-Duenweg Mining Belt, Jasper County, Missouri

The Oronogo-Duenweg Mining Belt is part of a 2,500-square-mile Tri-State mining district. Mining in this area began in the mid-1800s and continued through the 1960s. Jasper County, Missouri was home to seventeen lead, cadmium and zinc smelting operations in the late 1800s. The Jasper County Superfund site was added to the National Priority List in 1990, with an estimated 9 million tons of mine waste distributed throughout a 250-square-mile area. In 1991, the EPA and ATSDR conducted biomonitoring tests for lead levels in children throughout the area. The study documented blood-lead levels in local children at twice the level seen in the control area. Fourteen percent of children in the study had blood-lead levels over the CDC level of concern (10 ug/dl) (ATSDR, 2002b).

Doe Run Smelter, Herculaneum, Jefferson County, Missouri

Lead smelting at the Doe Run facility in Herculaneum, Missouri began in 1892. The current Doe Run lead smelter was built in 1969 and is the largest lead smelter in the U.S. (Doe Run, 2003). Significantly high levels of lead have been detected in soil, dust and air samples in the residential community surrounding the smelter. In 2002, the ATSDR conducted a health consultation to assess blood-lead levels in residents of Herculaneum. They found that 28% of the children tested had blood-lead levels higher than 10 ug/dl. Women aged 15-44 also had elevated blood-lead levels that were nearly twice the national average. While these levels may not cause adverse effects in the women themselves, lead can cross the placentas of pregnant women and adversely impact the developing brains of fetuses (ATSDR, 2002c).

Red Dog Mine, Alaska

The Cominco Red Dog lead-zinc mine, housed on Native corporation lands in northern interior Alaska, is the world's largest zinc mine. The mine site is extremely difficult to access and can be reached only by plane. The mining company, Teck Cominco, has tight control over who enters, and the private land status also restricts oversight.

Photo: Northern Alaska Environmental Center

A report released in 2001 by the National Park Service documented heavy metals, such as cadmium, lead and zinc, along a 24-mile section of the mine's 52-mile haul road in

Cape Krustenstern National Monument at concentrations as high as those present at the most polluted industrial sites in Eastern Europe (NPS, 2001). In the early 1990s, a monitoring program revealed lead levels in soils near the mine's port site as high as 36,000 parts per million (ppm) and zinc levels as high as 180,000 ppm. These levels are far in excess of Alaska's most lenient cleanup standards of 1,000 ppm for lead and 8,100 ppm for zinc (ENSR, 1990).

The Native Village of Kivalina, which depends heavily on regional subsistence foods for livelihoods, is located 15 miles north of the mine's seaport and 50 miles downstream from the mine. For hundreds of years, the village of Kivalina and other local Inupiaq tribes have used the areas directly adjacent to the haul road and the port as an important harvest area.. Air quality is also an issue at the mine. In December 1991, the Alaska Department of Environmental Conservation issued a warning to the Red Dog Mine that lead levels outside the mill were 30% higher than that considered protective of human health (Crook, 2003). Workers at the mine were advised to use respirators when outside.

Teck Cominco routinely violates Alaska air quality standards at the Red Dog mine. In 2001, the state fined Teck Cominco hundreds of thousands of dollars for air quality permit violations (ADEC, 2001). There has been ongoing concern in the village of Kivalina about toxic levels of zinc and other heavy metals in the creek near the mine coming from escapement of mine wastewater. The creek near Red Dog flows into the Wulik River, the village's source of fish and drinking water.

The complex mixture of chemicals in the mine tailings at the site is so volatile that it actually causes the tailings piles to steam. Groundwater underneath the tailing piles, heated by mine-related chemical reactions, has been measured at 700 degrees Fahrenheit. Area watersheds also have high lead levels. The Village of Kivalina rejected a health assessment recently completed by the Agency for Toxic Substances and Disease Registry because it was too limited in scope and did not fully evaluate contamination levels in subsistence foods. The Village has started their own health assessment that will take two to three years to complete (Crook, 2003).

Mercury Pollution Far and Wide

Mining is historically and currently a significant source of mercury pollution. Mercury is highly toxic to humans; large exposures can cause permanent brain and kidney damage. Additional nervous system effects include behavioral disorders, loss of sensation, blindness, deafness and mental retardation. During critical periods of development, children and fetuses are especially sensitive to even low levels of mercury exposure. Effects attributed to low-level exposure include lowered IQ, slowed development and impacts on attention, language skills and memory (ATSDR, 1999b).

The latest Toxic Release Inventory data show that the mining industry is responsible for 88% of all mercury releases reported in the U.S. In total in 2001, the mining industry put 4.3 million pounds of mercury into our air, water and soil. The predominate portion of these releases (99%) is in the form of waste rock disposed of on land (TRI, 2001).

Mercury bound up in waste rock appears relatively stable. The potential exists for mercury vapors to volatilize from waste rock, but this phenomenon has not been sufficiently studied or quantified.

Currently measurable air emissions of mercury from mining operations and smelters are substantial. Mining operations in the U.S. contributed nearly 13,000 pounds of mercury to our atmosphere in 2001 alone. This represents 9% of all mercury air emissions nationwide. Almost all of those 13,000 pounds, or 92%, are released from four major mining operations in the state of Nevada (TRI, 2001). This makes Nevada the state with the second highest emissions of airborne mercury nationwide (TRI, 2001).

Historically, liquid mercury was used in large quantities to recover gold in both placer and hardrock gold mines. It is estimated that 26 million pounds of mercury were used during the California Gold Rush, mostly in the Sierra Nevada and Klamath-Trinity mountain ranges. Three to eight million pounds of this mercury is likely to have been "lost" or released into streams and rivers in the mountains in the process (Alpers, 2000). Similarly, in Nevada, the gold and silver-rich Comstock ores were mined extensively with mercury amalgamation processes in the late 1800s (Gustin, 1994).

Today, the impacts of this extensive mercury use and disposal are still being felt downstream. The Bear River and South Yuba River watersheds in the Sierra Nevada range are currently being studied for mercury "hotspots" which pose risks to human health. The Carson River drainage in Nevada was chosen as a Superfund site in 1990 due to its high levels of mercury contamination (Gustin, 1994).

A major consequence of this extensive mercury contamination is the accumulation of mercury compounds in the tissues of fish and wildlife. While elemental mercury is less susceptible to uptake, mercury in its organic form (known often as methylmercury) accumulates readily in biota, and is the most toxic form of mercury to humans (Alpers, 2000). Biomagnification – an increase in the concentration of chemicals and chemical compounds – occurs as mercury is passed up the food chain. Mercury levels in fish have been known to be one to ten million times higher than the levels in their surrounding waters (USPIRG, 2003).

To help prevent mercury exposure in humans, fish consumption warnings have been issued in numerous watersheds contaminated with mercury. These advisories warn people to limit eating certain types of fish from a particular lake or river. In particular, children and women of childbearing age are warned to keep their consumption levels the lowest.

By 2002, state public health agencies issued 2,148 mercury fish consumption advisories . These advisories cover 12 million lake acres (approximately 30% of the nationwide total) and 450,000 river miles (13% of all river miles) (USPIRG, 2003). While western states tend to have issued fewer advisories than midwestern and eastern states, this trend may be influenced more by a lack of testing than a lack of mercury. For example, in Montana, of the hundreds of lakes in the state, just 25 were selected for testing by the Department of Public Health and Human Services. Of those 25 selected, fish from 20 lakes registered mercury levels high enough to warrant fish consumption advisories (MT-DPHHS, 2000).

Mercury-contaminated fish consumption has been found to be a primary pathway of mercury exposure in humans. In northern California, for example, fish and soil from an inactive mercury mine at Clear Lake were found to have elevated levels of mercury. Biomonitoring for mercury exposure was conducted among members of the Native American tribe living alongside Clear Lake. The researchers found that tribal members had higher levels of mercury in their blood and found a direct correlation between mercury levels in their bodies and reported fish consumption (Harnly, 1997).

Numerous studies have been conducted to assess the impacts of mercury exposure on human health. This report considers two such studies, one each from North and South America.

Mercury amalgamation is used widely in gold mining in the Amazon basin. Not surprisingly, fish and soil from areas near gold mines have been found to be heavily contaminated with mercury. One study of the effects on Amazonian children tested hair samples and found that the average levels of mercury exceeded health standards. When neurological tests were conducted on these children, they demonstrated significantly worse performance than children in the non-mining communities (Grandjean, 1999).

In central British Columbia, Teck Cominco operated the Pinchi Mine during the early '40s and from 1968-1975. The open pit mine was the main producer of mercury in British Columbia, and the site included a processing mill. The company sluiced raw mercury into Pinchi Lake when it cleaned the plant every evening and dumped waste-baked ore tailings into the lake, creating a long bar of toxic land. The Tl'azt'en First Nation communities living around the lake ate fish for breakfast, lunch and dinner.

Several studies of mercury contamination in fish from Pinchi Lake found that samples contained mercury levels near or greater than the maximum acceptable level of 0.5 ppm set by the Canadian Food and Drug Administration. One study found mercury concentrations in muscle tissue of Pinchi Lake fish as high as 10.5 ppm (Fimreite, 1970).

Members of the Tl'azt'en First Nation are greatly concerned about health problems they believe to be linked to the mercury contamination in and around Pinchi Lake. There is widespread distrust of the regulatory agencies' oversight of the contamination among tribal members.

The Risks of the Unknown: Libby, Montana

The story of mining's impacts to health in the small town of Libby, Montana illustrates the risks of exposure to sources other than the target mineral. In this case, the mineral mined for building materials at the Libby mine was not what endangered the town's residents. Rather, a substance previously largely unknown and locked in rock was released to the environment by large-scale mining and proved to be a health hazard.

Vermiculite was discovered in Libby in 1881 by gold miners prospecting in the area. It wasn't until 1919, however, that a use for vermiculite was identified: insulation material. By 1920, the Zonolite mining company had formed and continued mining vermiculite (called zonolite at the time) until 1963. At that point the mine was bought out by W.R. Grace (the company made famous in the book and movie "A Civil Action"), which operated the mine until it its closure in 1990 (U.S. EPA, 2003b).

The primary public health problem with the vermiculite in Libby is that it is contaminated with a naturally occurring form of asbestos called tremolite. Tremolite asbestos has unique physical characteristics that make it particularly toxic to humans. The tremolite fiber is long, thin and needle-like, which allows it to penetrate lung tissue and cause fibrosis, particularly of the pleura. The pleura are the membranes surrounding the lung and lining the walls of the lung cavity (Asbestos, 2003).

Asbestos is unique among mined materials in that some of the health effects and diseases it causes are quite specific to exposure. Asbestosis, mesothelioma and pleural disorders are strongly correlated and in some cases exclusively correlated to asbestos exposure (ATSDR, 2003a). This is unlike exposure to many other mining pollutants linked to more common conditions such as cancer, neurological and developmental disorders, all of which can be caused by a number of different factors. In Libby, the connection between the mining pollution and documented public health impacts is undeniable.

As would be expected, the miners who worked for W.R. Grace were highly exposed to asbestos and have suffered the greatest extent of disease. Occupational exposure to asbestos has been linked to greatly increased risk of lung cancer, mesothelioma and asbestosis. Recent epidemiological studies have shown that 51% of former W.R. Grace miners showed signs of pleural abnormalities on their chest x-rays. Five percent of former miners had moderate to severe restriction in breathing capacity (ATSDR, 2003a).

While preliminary studies on asbestos-related disease focused only on miners, later studies increased the scope to all residents of Libby and found astounding results. Community-wide testing found that 18% (almost one out of every five residents) showed evidence of pleural abnormalities. Of just those residents who never worked at the mine, 14% showed evidence of pleural abnormalities (Asbestos, 2003). The prevalence rate of pleural abnormalities in U.S. populations not exposed to asbestos is between 0.2 and 2.3% (ATSDR, 2002d). Numerous asbestos-related deaths have also been recorded in Libby. In 2000, the Agency for Toxic Substances and Disease Registry released a mortality study of all causes of death in Libby. This study found that between 1979 and 1998, death rates from malignant and non-malignant respiratory diseases were 40% higher than national rates. The death rate from asbestosis specifically in Libby was 63 times higher than expected (ATSDR, 2003a).

Non-occupational exposure to asbestos came from a number of sources associated with the mine. Tremolite asbestos is friable and transports easily when it becomes airborne. Mine workers brought asbestos home on their clothing and thus created significant exposure for their family members. The W.R. Grace company also used vermiculite mine tailings as a base material for a number of community projects. The ice rink at the Plummer school, the running tracks at both the middle school and the high school and a community baseball field were all built upon asbestos-laden vermiculite tailings. Tailings piles adjacent to the mine were also easily accessible and a favorite place for children to play (U.S. EPA, 2002a). Reported exposure to these sites was significantly correlated with increased risk of pleural abnormalities (ATSDR, 2002d.)

Libby was only recently added to the National Priority List for Superfund cleanup, in 2002. Additional testing and monitoring of the community is underway and cleanup plans are being developed. Due to several factors--previous and continued asbestos exposure among Libby residents of all ages, the length of time that can pass between exposure and illness, and the number of people who once lived in Libby and have since moved elsewhere--the full extent of health impacts from this site may not be understood for many years.

Section IV Worthy of Concern: Additional Issues Potentially Harmful to Human Health

Because this type of mining, particularly large-scale commercial heap leaching, has only been widely used for about 20 years we may not yet know the extent of the damage and human health effects.

Modern industrial-scale mining manifests other types of environmental degradation with the potential to threaten human health. Because this type of mining, particularly large-scale commercial heap leaching, has only been widely used for about 20 years we may not yet know the extent of the damage and human health effects. A few specific areas of great concern warrant mention and immediate further study.

Acid Mine Drainage and Inactive and Abandoned Mines

Photo: Montana Environmental Information Center

Inactive and abandoned mines (IAMs) can and do present a variety of environmental and public health problems. A recent scoping study conducted by the Western Governors' Association Mine Waste Task Force identified the following IAM statistics (U.S. EPA/DOE, 1996).

- **Montana:** over 20,000 IAM sites covering 153,800 acres, with 1,118 miles of stream damage
- **Arizona:** 80,000 IAM sites covering 136,653 acres, polluting 200 miles of surface waterways
- **Missouri:** 7,655 IAM sites covering 48,175 acres, with 109 miles of affected streams
- **Utah:** 25,020 acres affected by IAMs, with 83 miles of polluted streams
- **Colorado:** 20,299 mine openings and 1,298 miles of affected streams
- **California:** 2,484 IAM sites, 1,685 mine openings, and 578 miles of polluted streams
- **Idaho:** 27,543 acres affected
- **Oklahoma:** 26,453 acres affected
- **New Mexico:** 25,320 acres and 69 miles of streams affected

One environmental problem common to both active and inactive mines is acid mine drainage. Acid mine drainage results when water and oxygen react with naturally occurring sulfides in exposed rock to form sulfuric acid. This process can occur as groundwater flows through underground mine tunnels, or as rain or other surface water percolates through waste rock, leach and tailing piles. In addition to high levels of acidity in the discharge, lead, copper, zinc, cadmium, aluminum, iron, manganese and selenium are often leached out of rock, further contributing to environmental health impacts.

Human health impacts of acid mine drainage have not been extensively studied. At the Leviathan mine in Markleeville, California, however, the ATSDR conducted a public health assessment to determine the impacts of acid mine drainage on communities downstream. The Leviathan mine site was originally mined for copper sulfate in the 1860s. In the 1940s and 1950s, the site was developed into an open pit sulfur ore strip mine. Currently, 22 million tons of high-sulfur waste rock are distributed throughout the site and exposed to the elements (ATSDR, 2003b).

Acid mine drainage from the site affects several water bodies, including Leviathan, Aspen and Bryant Creeks, as well as the River Ranch Irrigation Channel. Aluminum, arsenic, cadmium, iron, manganese, nickel and thallium have all been found at elevated levels in surface water and sediments downstream of the site (ATSDR, 2003b).

The environmental impacts of the acid-mine-drainage pollution have been extensive. In 1959, a massive fish kill was reported in the East Fork of the Carson River. The fish kill occurred when a dike at the mine failed and released approximately five million gallons of acid mine drainage into Leviathan Creek (a portion of which eventually flowed into the East Fork). In 1969, a survey of the nine-mile stretch of Bryant Creek, which runs from the mine to the Carson River, found that it was completely toxic to fish and aquatic life and no longer supported a fishery resource. Multiple cattle deaths related to consumption of water in the area have also been reported (ATSDR, 2003b).

The ATSDR determined that exposure to elevated arsenic levels constituted the most significant human health threat posed by the site. They found that past and current surface water consumption and exposure from swimming or wading in surface water could result in a moderately increased cancer risk in humans. High levels of exposure to arsenic, manganese and thallium also presented an increased risk of non-cancerous effects to humans. (These effects include nausea, vomiting, tremors, lethargy, hair loss and damage to the kidneys, liver and intestinal tract.) As a result of their assessment, the ATSDR recommended avoidance of all contact with surface water at the site and in Leviathan and Aspen creeks. Limited exposure was recommended for Bryant Creek and River Ranch irrigation channel. A fish consumption advisory was established for all surface waters at the site (ATSDR, 2003b). National concern about the effects of manganese exposure to children has also increased. Recent research has shown associations between elevated manganese exposure and hyperactivity and learning disabilities (GBPSR, 2000).

Cyanide Spills

Cyanide is lethal in very, very small doses – it's estimated that only 50 to 200 milligrams of hydrogen cyanide ingested orally is fatal to humans. This is a quantity about the size of a grain of rice (Moran, 1998). Montana, the state with the phrase "Oro y Plata" (Gold and Silver) on its state seal, and the first state to pilot industrial-scale cyanide leach gold mining, also became the first state, in 1998, to ban via citizen initiative any new cyanide leach mines.

The U.S. mining industry points often to the fact that, despite cyanide's great toxicity, its use in mines has not killed any workers or people in surrounding communities. The industry's global record in the last decade has been less impressive. In 1995, a massive tailings dam failure at the Omai gold mine in Guyana allowed 860 million gallons of cyanide-laced tailings to flow into the Essequibo River, causing a massive fish kill. These events led other countries to impose a temporary ban on buying any fish from Guyana. In 1998, a truck transporting cyanide to the Kumtor gold mine in Kyrgystan flipped over and dumped two tons of sodium cyanide into a river. Hundreds of people were treated at area hospitals following the spill. In 2000, at the Baia Mare mine in Romania, a massive spill of mine waste laden with cyanide flowed into tributaries of the Danube River, killing fish for hundreds of miles downstream. A United Nations Environment Department report stated that the cyanide plume was measurable four weeks later at the delta of the Danube, 2000 kilometers from the source.

Industry defenders of cyanide use in mining often note how quickly cyanide breaks down when exposed to air and light. While its short life is a blessing, Robert Moran's report Cyanide Uncertainties, conducted for Earthworks, delineates the risks associated with the cyanide's breakdown compounds. While these compounds are less toxic than the original cyanide, they can potentially do more damage as some persist in the environment for long periods and others bioaccumulate in the food chain. Most regulatory agencies do not currently test for these breakdown compounds when monitoring mine pollution. Hence, potential health threats from cyanide use may be going largely undetected (Moran, 1998).

An equally troubling effect of cyanide is that its use facilitates profoundly physically destructive forms of mining. The use of cyanide in heap leaching at modern gold mines allows the industry to tear down entire mountains for a small pile of gold. Cyanide use exacerbate the impacts associated with acid mine drainage, heavy metal transport and bioaccumulation, dust and air pollution.

Threats to Drinking Water

Clean and safe drinking water, inarguably the natural resource most precious to humanity, is threatened by the impacts of mining across the globe. The risk of an operating mine releasing wastes into drinking water sources is ever-present. Numerous examples of catastrophic releases have been documented. A report by the EPA listed 95 major release incidents from mines and mineral processing facilities in eight states between 1990 and 1997 alone. For example, in 1991 in Gila County, Arizona, 3.4 million gallons of heavy-metal tainted water were released into Pinto Creek after a tailings dam failure at the BHP copper mine in Arizona. Pinto Creek feeds Roosevelt Lake, one of the area's largest sources of drinking water (U.S. EPA, 1997). In Hurley, New Mexico, between 1991 and 1996, a series of pipeline ruptures at the Phelps Dodge copper/molybdenum mine led to releases of almost 250,000 gallons of tailings into Whitewater Creek (SEPAL, 1997).

Subtler but equally dangerous hazards to drinking water arise from seepage at mining storage areas and process facilities. At the DuPont titanium processing plant in Tennessee, seepage from a waste dump on site caused extensive ground water contamination. Levels of beryllium, chromium, lead, mercury and nickel in the nearby groundwater were found to exceed federal drinking water standards (U.S. EPA, 1997). In El Paso, Texas, an ASARCO copper smelter was implicated in the contamination of the Franklin Canal, which runs adjacent to the facility and is a public drinking water source for the city. Arsenic-contaminated groundwater seeping into the canal contained arsenic levels significantly exceeding those deemed safe by federal drinking water standards (U.S. EPA, 1997).

Inactive and abandoned mines also threaten drinking water supplies around the country. A report by the Environmental Working Group identified 374 U.S. watersheds used for drinking water that were impaired or threatened by metal pollution. Many of these watersheds are polluted by runoff from abandoned mines. For example, the Upper Clark Fork watershed in Montana contains 250 miles of metal-polluted rivers and streams and is impacted by 212 abandoned mines. The Upper Carson watershed, which straddles California and Nevada, is home to 37 abandoned mines and106 miles of rivers and streams polluted by metals (EWG, 2002).

Another threat to the quality of future drinking water is the large number of undeveloped mining claims awaiting review. In Tenmile Creek's Upper Missouri watershed, near Helena, MT, an area already impacted by historical mining, 144 companies and individuals sit atop 1,886 claims, many of which remain likely to be developed. In Salt Lake City, UT, 684 mining claims, some staked as recently as 2002, are located in areas that drain directly into three local mountain creeks that provide the city 's drinking water (EWG, 2002).

Section V Transboundary Issues: Mining on the Canadian and Mexican Borders

Mining contamination knows no borders. Mining at or near the U.S. border creates contamination and public health problems that must be managed by more than one country, resulting in complex enforcement and reclamation situations. Two case studies of such situations are considered below.

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The U.S. – Mexican Border: Phelps Dodge Douglas Reduction Works

The Phelps Dodge Douglas Reduction Works was a former copper smelting operation located in Douglas, Arizona, near the Mexican border. Two smelters operated from the early 1900s until 1987, when the operations closed. Prevailing winds carried pollution from the smelter stacks to the north during the day and to the south (toward Agua Prieta, Mexico) at night. The smelters also illegally discharged contaminated wastewater into Whitewater Draw, a small, intermittent stream that flows across the border into Mexico (ATSDR, 1995).

Contamination from the Phelps Dodge facility stemmed from both air and water emissions. Air samples showed elevated levels of sulfates, arsenic and lead particulate in outdoor air in Douglas. Soil samples collected on-site revealed high levels of arsenic, cadmium, chromium, lead, copper and mercury. Soil samples within 2.5 miles of the site also showed higher than expected levels of lead, arsenic and copper. Municipal groundwater wells in both Douglas and Agua Prieta had elevated levels of arsenic. Samples of surface water from Whitewater Draw exceeded comparison values for several heavy metals (ATSDR, 1995).

Children's health in the Douglas and Agua Prieta areas was significantly affected by the contamination from the Phelps Dodge smelters. In 1975, the CDC collected and tested hair samples and found that children in Douglas had increased exposure to lead, arsenic and cadmium when compared to Arizona children in non-smelter communities. A follow-up study in 1985 found the average blood-lead levels of children living near the smelter to be double the CDC recommended level of 10ug/dl. In 1995, the ATSDR concluded that the Phelps Dodge site posed a public health hazard to children living in both Douglas and Agua Prieta.

The smelter site has since been dismantled and removed, with the exception of a slag pile and several landfills. The ATSDR is cooperating with Mexican authorities to promote and carry out public health assessments and follow-up activities at several U.S.-Mexican border sites, including Douglas.

The U.S. – Canada Border: Teck-Cominco Trail Smelter

The Teck Cominco Trail smelter is a lead and zinc smelter located on the banks of the Columbia River in Trail, British Columbia. A smelter has been operating at the site since the early 1900s. The original smelter, replaced in 1997, was a major source of lead pollution, emitting up to 300 kilograms of lead each day. As early as 1975, blood-lead studies in children who lived in Trail showed average blood lead levels significantly higher than in comparison non-smelter communities. Follow-up studies in 1989 found that almost 40% of children in Trail had blood-lead levels over 15 ug/dl (THEC, 2003b).

These studies led to further investigation of the contamination around the site. Not surprisingly, soil samples near the smelter were found to include lead, arsenic and cadmium at levels exceeding standards set by Canadian environmental regulations. A number of pollution control activities were instituted, including the eventual replacement of the old smelter in 1997 (THEC, 2002).

Photo: Kettle Range Conservation Group

Historic and current pollution from the smelter continue to create health impacts near and far from the site. The smelter's location on the banks of the Columbia River made for convenient disposal of Teck Cominco's slag (a heavy-metal-laden byproduct of the smelter). Contaminants from the dumped slag have been moving downstream for decades. The completion of the Grand Coulee Dam in 1937 created Lake Roosevelt and provided a physical barrier to further distribution of the slag contaminants. Since 1937, the smelter has dumped 9.8 million tons of slag into the Columbia. Between 1992 and 2001, Teck Cominco also discharged just under 2000 pounds of mercury directly into the river (Confederated Tribes, 2003b). Over the past 15 years, multiple studies of fish and sediments from Lake Roosevelt have reported significantly high levels of arsenic, mercury, cadmium, copper, lead, zinc, dioxins, furans and PCBs (Confederated Tribes, 2003a). Fish consumption advisories have been issued for Lake Roosevelt.

The Confederated Tribes of the Colville reservation have led the effort toward remediation of Lake Roosevelt. The tribe has petitioned the EPA to add Lake Roosevelt to the National Priority List for Superfund cleanup. The transboundary nature of the contamination has made this issue difficult to address. In January 2003, Canadian authorities denied the EPA's request to sample for heavy metals near the Trail smelter due to a lack of protocol for conducting Superfund processes in Canada. The two Canadian and American authorities are currently working to find resolution on this issue (Associated Press, 2003).

Section VI

Social and Emotional Health Impacts

The impacts of mining may have negative effects on the quality of life and lifestyle choices of a particular community. Individuals may exhibit physical or mental/emotional illness and the behavior of entire communities may change substantially.

When local soils, drinking water or food supplies have been contaminated, the risks to health may be both real and perceived. Even a perceived health threat can have real implications on the wellness of a given community. The fear of being poisoned is a powerful deterrent to the traditional habits and choices on which a culture is based.

Even a perceived health threat can have real implications on the wellness of a given community. The fear of being poisoned is a powerful deterrent to the traditional habits and choices on which a culture is based.

This type of tangible effect based on a perceived threat was seen in the months and years following the Exxon Valdez oil spill in Prince William Sound, Alaska. Indigenous communities living and fishing for subsistence seafood made substantial changes to their traditional food gathering techniques. Many of these changes were warranted and were in response to government warnings about specific foods to avoid. Amidst the larger tragedy was the complex way tides, currents and storms carried oil and distributed it on beaches throughout the Sound. Some areas were smothered in the toxic slime and others were left untouched. For many people living in villages throughout the area, it was difficult to feel certain that a particular fishing ground was “safe.” Hence, diets changed dramatically during that time, even in areas that had not been contaminated.

A diet less dependent on wild traditional foods and more dependent on trips to grocery stores in Anchorage has physical as well as cultural, social and economic impacts. According to a fact sheet compiled by the Exxon Valdez Oil Spill Trustee Council, "Household interviews conducted with subsistence users in communities throughout the spill area in 1989 indicated that subsistence harvests of fish and wildlife in most of the communities declined substantially following the spill. Key factors in the reduced harvests included reduced availability of fish and wildlife, concern about possible health effects of eating oiled fish and wildlife, and disruption of the traditional lifestyle due to cleanup and related activities" (Exxon, 2003).

Similar scenarios can be found in mining communities. Following are just a few examples of the potential health impacts generated by the fear of being poisoned.

Fort Belknap Reservation, Montana

Home to the Assiniboine and Gros Ventre Tribes, Fort Belknap is also home to Montana’s largest cyanide-process gold mine. The mine was abandoned in the late 1990s by its Canadian owner, Pegasus Gold, which is now bankrupt. Pegasus Gold’s departure followed a lawsuit by the Fort Belknap tribes and several environmental groups challenging a proposed expansion that would double the size of the mine, despite 22 violations of the Clean Water Act. At one point when the mine was active, drinking water taps in the nearby town of Zortman flowed with cyanide-laced

Photo: Indian Law Resource Center

water. Some tribal members continue to fear today that the mine is making them sick. They wonder if rising rates of diabetes and unusual illnesses in their community are attributable to the mine. The ATSDR conducted a study on potential health impacts from the mine and found no direct connection, but they did document health ailments common today in Indian country (ATSDR, 1999a).

Regardless of ATSDR's official findings, there is little dispute that traditional uses of the Little Rocky Mountains where the mine is located have been seriously disrupted, from the practice of vision questing to the gathering of traditional plants. Furthermore, the mining company's declaration of bankruptcy means that American taxpayers will pick up the bill for cleanup, and thus far the responsible agencies have not provided sufficient funds to ensure comprehensive cleanup. At Fort Belknap, young and old people alike despair over the gaping hole and the adjacent piles of blasted waste rock that may always remain in the earth where Spirit Mountain used to rise. The unhealthy landscape fosters an unhealthy community, emotionally and physically.

Yarnell, Arizona

In this small community of about 1,000 residents, a new open-pit cyanide-leach mine has been proposed immediately adjacent to houses and a residential neighborhood. The majority of the town's residents are elderly and concerned about the potential threats of cyanide reaching drinking water wells and winds carrying dust to a population more vulnerable to these risks. Locals also fear that blasting at the mine site will dislodge the enormous boulders that sit loosely on this desert landscape and could either harm someone traveling on the road or possibly block the highway itself. The Canadian company proposing the mine acknowledged this possibility and suggested that "mitigation" would involve stopping traffic for up to 30 minutes at a time during blasting periods. Local residents were not reassured, as the highway through town is the only route to the north and south and area hospitals. For the elderly residents of Yarnell, the mere idea of a 30-minute wait in an ambulance before being able to reach a hospital was itself frightening (Da Rosa, 1997).

Pony, Montana

Historic mining helped settle the small wild-west town of Pony, Montana. Small pick-and-shovel mines and tailings piles are littered throughout the Tobacco Roots Mountains where Pony is located. Many residents of Pony appreciate the pioneering spirit of the first white settlers. The challenge for Pony came, however, with a mill constructed to process gold ore from the many surrounding small mines. This mill, with its cyanide-laced pond perched precariously on a hill above town, for years was poorly operated and run by suspicious characters with reputed criminal backgrounds. When trace amounts of cyanide were found in the town's well water people suspected their worst fears had been realized. And there was always the possibility of a catastrophic disaster if the cyanide pond was to accidentally burst one of its banks and spill its poisons into town.

Salt Lake City, Utah

Few communities have been as welcoming of large industrial-scale mines as Salt Lake has been of its long-time neighbor, the Rio Tinto-Kennecott Bingham Canyon copper mine. This open pit copper mine has provided welcome jobs and endeavored to demonstrate model reclamation techniques on its massive waste rock piles (easily visible as one flies in and out of the Salt Lake airport). Beneath the Bingham Canyon mine, however, lies the largest known plume of contaminated groundwater in the world. While trying to remain positive and non-confrontational, area residents and conservationists must be constantly vigilant to ensure the plume is not accidentally(or intentionally) released from its pocket beneath the mine site and into the fragile and unique ecosystem of the Great Salt Lake.

Section VII
The Challenges of Cleanup

One of the greatest challenges in addressing health impacts in mining communities is that no one knows how to fix the problem. Many millions of dollars have been invested by the mining industry into the science of how to extract ever smaller concentrations of gold from rock, but very little has gone into determining how to put the earth back together once it has been blasted, crushed and saturated with chemicals. The limits of current engineering knowledge and paucity of viable choices for returning land to its pre-mining condition offer strong testimony as to why these problems should avoided or prevented in the first place.

Many millions of dollars have been invested by the mining industry into the science of how to extract ever smaller concentrations of gold from rock, but very little has gone into determining how to put the earth back together once it has been blasted, crushed and saturated with chemicals.

A small number of experienced mining engineers are now working with environmental and community-based organizations to identify best possible reclamation options. Unfortunately, the best options for cleaning up abandoned mines are usually incredibly expensive. State and federal agencies often lack the political will and foresight to require secure reclamation bonds to cover cleanup costs before a disaster strikes or the company declares bankruptcy. Hence, taxpayers are left with the cost of reclaiming the land and reducing sources of harm to environmental and human health. State agency representatives in New Mexico recently estimated cost of cleanup for two large open-pit copper mines to be more than $800 million.

The Canadian-owned Summitville gold mine in the mountains of Colorado has already cost the U.S. Superfund program $150 million dollars for cleanup, and still the Alamosa River (downstream from the mine) flows with acid mine drainage. The tremendous financial costs have created frustration in the EPA, inciting debate about whether mining cleanups should be exempt from Superfund – not because they are less toxic or hazardous to health but rather because one cleanup alone could cost the entire program's budget.

Of course, the cost of mine reclamation is not the only challenge facing the Superfund program. In the current political climate, the financial and programmatic future of the entire law is in jeopardy. While some may critique the flaws of Superfund, few other tools exist to assist the communities most devastated by health-threatening pollution. As more mines close, the price tag for the collective cleanup of those for which a company isn't picking up the bill will continue to grow.

Section VIII
Opportunities

Despite the compelling and critical nature of mining impacts to human health, very few resources are currently being invested to address the issues. In most cases, this is because communities directly affected are rural, remote and relatively small in population. This also means that even before facing a conflict with modern mining few communities had political voice or influence. The problem is further exacerbated by the reality that where mining occurs, the mining industry carries tremendous political clout. In some cases, prominent local officials will deny an obvious problem because they fear the stigma of being labeled a toxic site and the subsequent damage to the local economy. Chambers of Commerce and tourism bureaus are sometimes the first to aid in downplaying questions of environmental risk. As a result, it may be difficult for outside advocacy groups and potential funders of environmental health advocacy to get a clear picture of the problem and its significance without independently funded primary research.

Investment in improving the health of mining-impacted communities will serve not only to reduce the current exposure and risk, but also to illustrate the need for broader changes in the policy context that allowed the contamination to occur.

While political realities and scarce resources can make the issue seem overwhelming, it is also true that a relatively small amount of new money to support mining health advocacy efforts can make a big difference, particularly in key areas. Investment in improving the health of mining-impacted communities will serve not only to reduce the current exposure and risk, but also to illustrate the need for broader changes in the policy context that allowed the contamination to occur. This increased awareness can assist in feeding a political imperative for reform of mining laws and regulations. Finally, providing financial resources to expose mining's health impacts will raise important issues associated with fundamental environmental laws the mining industry has treated as mere suggestions.

Comprehensive environmental laws with adequate monitoring enforcement would have prevented nearly all of the damage done in mining communities. The integrity of Superfund, the Clean Water Act, the Clean Air Act, the National Environmental Policy Act, the Endangered Species Act and the Freedom of Information Act are all intimately tied to resolving the problems associated with mining. Similarly, to discuss mining's health impacts is to directly address the needs of indigenous communities, the health of rivers and entire watersheds and food safety.

In several western towns and states organizations are giving voice to the stories of mining-impacted communities. Energy is being focused on determining best possible reclamation plans to protect human health and translating this into precedent-setting change to prevent future damage. Several efforts are worth mentioning specifically. In each case, current organizations addressing the issues are mentioned, but new groups with potential to move the issues further should also be considered in each case.

Libby, Montana
In a community rocked by hundreds of deaths associated with modern mining, residents of Libby, Montana have taken seriously the need for comprehensive cleanup of asbestos contaminated soils. An excellent news series presented by the Seattle Post-Intelligencer first brought this story to front-page headlines in the late 1990s; this coverage was followed by 60 Minutes and People magazine. Montana Governor Judy Martz, a self-defined "lap dog of industry," was swayed to bring federal Superfund designation to the site by a well-organized local effort. As a result, local advocacy interest extends beyond the mine site itself to include work in support of the health of the Superfund program. The declared bankruptcy of mining company W.R. Grace has left the community with few other options for reclamation dollars.

Groups who have worked directly on this issue:

- Gayla Benefield, Lincoln County Asbestos Victims Relief Organization, and Superfund Technical Assistance Group (Libby, Montana)
- Montana Environmental Information Center (Helena, Montana)

New Mexico and Nevada: A Collaborative Campaign
Some of the most powerful campaigns to change the mining industry's practices have been focused not on the slow bureaucracy of governmental regulation, but rather on the corporations themselves. By exposing the irresponsible track record of a particular company, impacted communities can encourage increased vigilance in the permitting process in regions where the company is proposing a new mine. Greater scrutiny adds time and money to the company's process because it requires a more thorough review of the proposed mine. Ultimately, this contributes to protecting health and forcing the company to change its practices overall. In one such corporate-focused campaign, groups in New Mexico and Nevada have joined together to shine light on Molycorp (a subsidiary of corporate giant Unocal), and the health impacts associated with two Molycorp mines. One mine is located in Questa, New Mexico, the other in the California desert, the Mountain Pass mine.

Groups who have worked directly on this issue:

- Amigos Bravos (New Mexico)
- Great Basin Mine Watch (Nevada)

Indian Country: Uranium and Bureaucracy
In what has become an agonizingly long campaign, tribal members and supporting organizations continue to advocate for comprehensive cleanup of uranium mines across the western U.S. Some legislative attempts have been made to address the issue, such as the Radiation Exposure Compensation Act (RECA). Restitution has not come easily; residents who lived downwind of mines and widows of miners still find their claims stymied by bureaucratic loopholes or lack of funding to pay even what the government acknowledges they deserve. President John F. Kennedy's Secretary of the Interior, Stewart Udall, who worked to achieve this compensation, expressed his frustration recently at how little had been done to address the need and rebuild the trust that the U.S. government violated in Indian Country.

Amidst all this, questions remain as to the current health threats associated with the mine sites. Some tribal governments have taken leads to protect their own members in places such as Acoma Pueblo, Laguna Pueblo, the Navajo Nation and the Spokane Reservation, but the size of the task is daunting. Collectively, groups of indigenous representatives of impacted communities continue to return to Washington, DC to ask Congress to right the wrong.

In a related case, groups continue to advocate for removal and comprehensive cleanup of the Atlas Mill tailings, radioactive waste left along the banks of the Colorado River in Moab.

Finally, and perhaps most pressingly, many also work to ensure that the proposed new uranium mine at Crownpoint, New Mexico is not permitted.

Groups who have worked directly on this issue:

- Dine Care (Colorado)
- Laguna-Acoma Coalition for a Safe Environment (New Mexico)
- Eastern Navajo Dine Against Uranium Mining (New Mexico)
- Mining Impact Communication Alliance (New Mexico)
- Southwest Research and Information Center (New Mexico)
- Dawn Watch (Washington)
- Grand Canyon Trust (Utah/Arizona)
- Indigenous Environmental Network (Minnesota)
- Mining Watch Canada (Ottawa, Ontario)

Alaska, British Columbia and Washington State: The Teck Triangle

Teck Cominco's mining operations have created a path of pollution extending from the Red Dog mine in the northernmost reaches of Alaska to the Trail smelter in British Columbia and into the Columbia River of Washington state. The company's mining and smelting activities have resulted in some of the most extensive and severe contamination in the United States and Canada. A coalition of groups from Alaska, Canada and Washington is focusing attention on Teck Cominco's operations in those regions. The coalition has several overarching goals: hold Teck Cominco accountable for cleanup of existing impacts to the environment and communities (e.g., cleanup of Lake Roosevelt, Lake Pinchi, etc.); force Teck Cominco to improve its mining practices at existing operations (e.g., Red Dog); and support legislative reform (e.g., Washington Bad Actor Provision, Canadian Abandoned Mines Act, Alaska state mining reform).

Groups who have worked directly on this issue:

- WashPIRG (Washington)
- Environmental Mining Council of British Columbia
- Northern Alaska Environmental Center
- The Lands Council (Washington)
- Alaskans for Responsible Mining
- Earthworks

Lead Threats to Children

Silver Valley, Idaho

In the region that continues to have one of the nation's highest blood-lead levels in children, area residents, advocacy groups and tribal governments are working for cleanup. Focus is not only on the health of communities nearest the mines but also the waterways that have carried lead and other heavy metals across the state line into Washington. The Coeur d'Alene Tribe has already made promising headway in restoring lakes and streams on tribal lands. The tribe continues to be a powerful proponent for comprehensive cleanup; scarcity of resources to support the effort remains the greatest impediment.

Groups who have worked directly on this issue:

- Coeur d'Alene Tribe (Idaho)
- The Lands Council (Washington)
- Earthworks (Montana)
- Silver Valley People's Action Coalition (Idaho)
- Women's Voices for the Earth (Montana)

Midwest Lead Belt

More than half-a-dozen Native American tribes and many communities in the Midwest's "lead belt" have been impacted by contamination from lead-zinc mines that operated from the early 1900s through the 1970s. After a painful history of illness and threats to child development, current efforts focus on cleanup and reducing ongoing exposure.

Groups who have worked directly on this issue:

- Quasar Tribe
- Missouri Heartwood
- Indigenous Environmental Network

Groups with related knowledge that could be engaged on lead issues related to mining in both regions:

- Community Toolbox for Children's Environmental Health (California)
- Institute for Children's Environmental Health (Washington)

Air Pollution from Smelters

Nevada

Smelting makes Nevada the second highest emitter of airborne mercury pollution among U.S. states. In trade magazines, the mining industry ranked Nevada as its number one place to operate. A loose regulatory system favorable to industry and the support of powerful politicians such as Senator Harry Reid have given companies virtual permission to pollute. But the collaborative work of nonprofit organizations is dramatically changing the lax regulatory climate the industry has come to expect in Nevada. The coming shift was illustrated recently in Nevada newspapers when two environmental managers at one of the world's wealthiest mining companies, Newman, publicly left the company to expose environmentally irresponsible corporate practices and to affirm the claims of advocacy organizations.

Groups associated with this work:

- Great Basin Mine Watch (Reno, Nevada)
- Western Shoshone Defense Project (Crescent Valley, Nevada)
- Earthworks (Colorado)

Arizona/New Mexico
In addition to sharing state and Mexican borders, these two states also share a similar geology that has made copper king, and smelters prevalent. While most of the smelters on the Mexican border and throughout the two states have closed, the toxic heavy metals are left behind. Important new work is being done to address the contamination.

Groups who have worked directly on this issue:

- Gila Resources Information Project (New Mexico)
- Copper Fist (Arizona)
- Southwest Research and Information Center (Albuquerque, New Mexico)

Mercury in Western Watersheds
The proliferation and accumulation of mercury in rivers, fisheries and our bodies is of increasing concern. Pollution in waterways is substantial.Pregnant women are actively encouraged to avoid certain fish species that have high mercury content. In Montana, the nation's fly-fishing capital, more than 25 water bodies already have fish advisories for women and children related to elevated mercury levels. In California, where mercury was widely used in gold mining and where several abandoned mercury mines exist, groups are doing extensive work on the issue. In Washington state, precedent-setting work has been done at the state legislative level to reduce mercury pollution statewide. This legislative progress regarding mercury pollution in general could be used to help forward the mercury poisoning issues related to mining and health.

Groups associated with this work:

- Montana PIRG (Montana)
- Great Basin Mine Watch (Nevada)
- Women's Voices for the Earth (Montana)

Groups working on mercury issues more generally:

- Washington Toxics Coalition (Washington)
- Mercury Policy Project (Vermont)
- US PIRG (Washington, DC)

Additional Resources and Opportunities

MiningWatch Canada, in Ottawa, Ontario, is doing substantial work on mining and health threats in Canada and working to reform the practices of Canadian mining companies operating around the world.

Western Mining Action Project is a nonprofit law firm providing a full spectrum of legal services at no charge to grassroots citizen groups dealing with mining issues. They also handle important national level lawsuits relating to mining. Indian Law Resource Center also provides legal support to indigenous groups on a number of issues and has handled mining cases as well.

Several organizations not currently focusing on mining issues but with extensive experience in environmental health science or health campaigns might also provide assistance.

- Physicians for Social Responsibility (Washington, DC)
- Science and Environmental Health Network
- Institute for Children's Environmental Health, and the collaborative Partnership for Children's Environmental Health (Washington)
- Environmental Health Fund (Massachusetts)
- Commonweal (California)
- Community Toolbox for Children's Environmental Health (San Francisco)
- Women's Voices for the Earth (Montana)
- Indian Law Resource Center

A new campaign, Westerners for Responsible Mining, represents a collaboration of dozens of groups from across the U.S. working to reform laws, regulations and corporate practices. The coalition is a diverse mix of ranchers, sportsmen and women, local residents, tribal members, Republicans, Democrats, environmental organizations and many others. They share a common interest in bringing accountability to modern mining. The growing power and momentum of this campaign and new resources invested to fund the effort provide an opportunity to further leverage new funds focused on human health advocacy.

Section IX
Conclusions

The risks posed to human health by both historic and modern mining are real. In specific locations, such as Libby, Montana, and Laguna Pueblo, New Mexico, mining has done devastating harm to the health of individuals, whole families, neighborhoods and entire towns and communities. Since little documented research has quantifed the level of the threat, and little attention has been paid to reducing the risk, people continue to be exposed to toxic levels of pollution today.

New efforts to reform modern mining and adequately provide for the cleanup of abandoned mines provide a timely opportunity to protect the health of people. This protection will benefit not only those living closest to mines, but also those of us living many miles downstream or downwind. Similarly, it will protect the food chain on which we all depend.

It is essential that we require regulatory agencies to fully establish the risks associated with proposed new mines. Additionally, these agencies must monitor the full range of pollutants that threaten health. This information should be provided in a form easily accessible and comprehensible to the general public. Local communities must be engaged in the permitting and oversight of the industries directly impacting their communities. Finally, agencies must require secure reclamation bonds sufficient to cover the comprehensive costs of protecting human health many decades after the mine has closed.

These provisions, which account for the true costs of mining, will better protect the health of people working in, living near and otherwise impacted by modern hardrock mining.

Exhibit A
Organizations Mentioned in the Report

Alaskans for Responsible Mining
c/o Alaska Conservation Alliance
810 N. Street, Suite 203
Anchorage, AK 99501
Tel:(907) 258-6171
Fax: (907) 258-6174
Email: roger@featherstone.ws

Amigos Bravos
P.O.Box 238 / 106 Doña Luz
Taos, NM 87571
Tel: 505-758-3874
Fax: 505-758-7345
email: bravos@amigosbravos.org
http://www.amigosbravos.org/

Coeur d'Alene Tribe (Idaho)
email: info@cdatribe-nsn.gov
http://www.cdatribe.org/

Commonweal
P.O. Box 316 / 451 Mesa Road
Bolinas, CA 94924
Tel: 415-868-0970
Email: commonweal@aol.com
http://www.commonweal.org/

Community Toolbox for Children's Environmental Health
999 Sutter St., 4th Floor
San Francisco, CA 94109
Tel: 415-614-9533
Fax: 415-614-9537
Info@communitytoolbox.org
http://www.communitytoolbox.org/

Copper Fist (Arizona)
http://www.fastq.com/~dwaz/copper.html

Dawn Watch
P.O. Box 193
Springdale, WA 99173
Tel: 509-937-2093

Dine' Care
10A Town Plaza, Suite 138
Durango, CO 81301
Tel: 970-259-0199
email: kiyaani@frontier.net
http://dinecare.indigenousnative.org/

Eastern Navajo Dine Against Uranium Mining
P.O. Box 150
Crownpoint, NM 87313
Tel: 505-786-5209
Fax: 505-786-7275
http://www.endaum.org/

Environmental Health Fund
41 Oakview Terrace
Jamaica Plain, MA 02130
Tel: 617-524-6018
Fax: 617-524-7021

Environmental Mining Council of British Columbia
#201--607 Yates St.
Victoria, B.C.
Canada V8W 1L0
Tel: 250-384-2686
Fax: 250-384-2620
Email: info@miningwatch.org
http://emcbc.miningwatch.org/emcbc/index.htm

Gayla Benefield, Lincoln County Asbestos Victims Relief Organization, and Superfund Technical Assistance Group
245 Cedar Meadow Rd.
Libby, MT 59923
email: gaylab@libby.org
http://www.libbymontana.com/epacag.html
http://www.epa.gov/region8/superfund/libby/

Gila Resources Information Project
306 N. Cooper
Silver City, NM 88061
Tel: 505-538-8078
email: GetaGRIP@zianet.com
http://www.gilaresources.info/

Grand Canyon Trust
2601 N. Fort Valley Road
Flagstaff, Arizona 86001
Tel: 928-774-7488
Fax: 928-774-7570
Email: info@grandcanyontrust.org
http://www.grandcanyontrust.org/

Great Basin Mine Watch
P.O. Box 10262
Reno, Nevada 89510
Tel: 775-348-1986
Email:tom@greatbasinminewatch.org
http://www.greatbasinminewatch.org/

Indian Law Resource Center
602 North Ewing Street
Helena, MT 59601
Phone: (406) 449-2006
Fax: (406) 449-2031
Email: mt@indianlaw.org

Indigenous Environmental Network (National Office)
P.O. Box 485
Bemidji, Minnesota 56619 - USA
Tel: 218-751-4967
Fax: 218-751-0561
email: ien@igc.org
http://www.ienearth.org/

Institute for Children's Environmental Health, and the collaborative Partnership for Children's Environmental Health
1646 Dow Road
Freeland, WA 98249
Phone: 360-331-7904
Fax: 360-331-7908
E-mail: emiller@iceh.org
http://www.iceh.org/ and
http://www.partnersforchildren.org

Laguna-Acoma Coalition for a Safe Environment (New Mexico)

The Lands Council
921 W. Sprague, Suite 205
Spokane, WA. 99201
Tel: 509-838-4912
http://www.landscouncil.org

Mercury Policy Project
1420 North Street
Montpelier, VT 05602
Tel: 802-223-9000
email: info@mercurypolicy.org
http://www.mercurypolicy.org/

Earthworks
1612 K Street NW, Suite 808
Washington, DC 20006 -
Tel: 202-887-1872
http://www.mineralpolicy.org

Mining Impact Communication Alliance
P.O.Box 238
Taos, NM 87571

Missouri Heartwood

Montana Environmental Information Center
P.O. Box 1184
Helena, MT 59624
Tel: 406-443-2520
Fax 406-443-2507
email: meic@meic.org
http://www.meic.org/

Montana PIRG
360 Corbin Hall
Missoula, MT 59812
Tel: 406-243-2908
Email: montpirg@pirg.org
http://www.montpirg.org/

Northern Alaska Environmental Center
830 College Road
Fairbanks, AK 99701
Tel. 907-452-5021
Fax: 907-452-3100
Email info@northern.org
http://northern.org/

Physicians for Social Responsibility
1875 Connecticut Avenue, NW, Suite 1012
Washington, DC, 20009
Tel: 202-667-4260
Fax: 202-667-4201
Email: psrnatl@psr.org
http://www.psr.org/

Quapaw Tribe
P.O. Box 765
Quapaw, OK 74363
Tel: 918-542-1853
Fax: 918-542-4694
Email: quapaw@eighttribes.org
http://www.eighttribes.org/quapaw/

Science and Environmental Health Network
3704 W. Lincoln Way #282
Ames, IA. 50014
Tel: 515-268-0600
Fax: 515-268-0604
http://www.sehn.org/

Silver Valley People's Action Coalition
P.O.Box 362
Kellogg, ID 83837
Tel: 208-784-8891

Southwest Research and Information Center
PO Box 4524
Albuquerque, NM 87106
Tel; 505-262-1862
Fax: 505-262-1864
Email: Info@sric.org.
http://www.sric.org/

US PIRG
218 D St. SE
Washington, DC 20003
Tel: 202-546-9707
Email: uspirg@pirg.org
http://www.uspirg.org/

Washington Toxics Coalition
4649 Sunnyside Ave N Suite 540
Seattle, WA 98103
Tel: 206-632-1545
Fax: 206-632-8661
Email: info@watoxics.org
http://www.watoxics.org

WashPIRG
3240 Eastlake Avenue E, Ste 100
Seattle, WA 98102
Tel: 206-568-2850
http://www.washpirg.org/

Western Mining Action Project
2260 Baseline Road, Suite 101A
Boulder, CO 80302
Phone: (303) 473-9618
email: wmap@igc.org

Western Shoshone Defense Project
P.O. Box 211308
Crescent Valley, NV 89821
Email: wsdp@igc.org
http://www.wsdp.org/

Women’s Voices for the Earth
P.O. Box 8743
Missoula, MT 59807
Tel: 406-543-3747
Fax: 406-542-5632
Email: wve@womenandenvironment.org
http://www.womenandenvironment.org

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